**Math Standards Requiring Use of Graphics Calculator**

**Notes from Introduction to Mathematics Curriculum Standards:**

The standards relating to functions and graphs should be taught and learned in tandem. In Grades 7 and 8, the main emphasis is on linear functions and their graphs. A graphics calculator, or graph plotting software, has an important role in these standards since it helps students to learn from exploring problems.

Basic calculators, when used to carry out tedious calculations, allow students to focus on the strategies needed to solve a problem. They can also be a useful support when students are learning arithmetic to help them to grasp ideas such as place value. Scientific calculators are used for more complex calculations, including work with trigonometric ratios and some statistical work.

Graphics calculators and function graph plotters can help students to learn about graphing – they are not just an efficient tool to use when students have mastered the basics. They allow students to see instantly the graphs of complex functions and to explore the impact of changes. They can also display statistical diagrams, and can be used to develop algebraic identities.

*(Copied from pages 16 to 17 of the Introduction to Mathematics Curriculum Standards*

**Standards Where Use of Graphics Calculator is either Required or Highly Recommended**

| **Grade** | **Standard** | **Details** |
| --- | --- | --- |
| 8 | 8.8.2 | Use the [ANS] key (from Casio graphics calculator) or [ENTER] key (from a Texas Instruments graphics calculator) to generate term-to-term and position-to-term sequences. |
| 9 | 9.4.1 | Use a graphics calculator and a function graph plotter to plot graphs.  *Use a graphics calculator to draw these quadrilaterals* |
|  | 9.5.4 | 9.5.4 Use a graphics calculator to plot a range of simple functional relationships, some continuous and others discontinuous, arising in familiar contexts. |
| **10, 11 AND 12 FOUNDATION** | | |
| 10 FDN | 10F.4.3 | Sum arithmetic sequences, including the first *n* consecutive integers, and give a ‘geometric proof’ for the formulae for these sums. |
| 10F.9.1 | Draw scatter diagrams between two random variables associated with some common context; identify through elementary qualitative discussion positive and negative correlation; where there appears to be correlation, draw a line of best fit, judging by eye the line about which the data points are most evenly distributed.  *Use a graphics calculator to draw scatter diagrams* |
| 11FDN | 11F.5.01 | Use a graphics calculator to plot and interpret a range of functional relationships, some continuous and others discontinuous, arising in familiar contexts |
| 11F.5.10 | Model a range of situations with appropriate quadratic functions. |
| 11F.5.13 | Find approximate solutions of the quadratic equation *ax*2 + *bx* + *c* = 0 by reading from the graph of *y* = *ax*2 + *bx* + *c* the *x*-coordinate(s) of the intersection point(s) of the graph of this function and the *x*-axis. |
|  | 11F.5.14 | Find exactly by algebraic means, and approximately from the points of intersection of a straight line with the graph of a quadratic function, the solution set of two simultaneous equations L1 and Q1*,* where L1 represents a linear relation for *y* in terms of *x*, and Q1 a quadratic function of *y* in terms of *x* |
| 11F.5.16 | Understand the statement *y is inversely proportional to x* and set up the corresponding equation *y* = *k/x*; know some characteristics, including that *x* ≠0 and that *x* = 0 is an *asymptote* to the curve, as is *y* = 0; study examples of inverse proportionality. |
| 12FDN | 12F.5.1 | Use a graphics calculator, including the trace function, to show approximate solutions to physical problems requiring the location and physical interpretation of the intersection points of two or more graphs. |
| 12F.5.8 | Understand the ideas of exponential growth and decay and the forms of the associated graphs *y* = *ax*, where *a ≠*0; use a graphics calculator to plot the graphs of the exponential function, e*x*, and the natural logarithm function, ln *x*; know that one is the inverse function of the other and use this to find solutions to physical problems; solve for *x* the equation *y* = *ax* and use this in problems; use the log function (logarithm in base 10) on a calculator. |
| 12F.13.1 | Use coins, dice or random numbers to generate models of random data.  [These can be generated on scientific or a graphics calculator using the RND and RAN function keys.] |
| **10, 11 AND 12 ADVANCED** | | |
| 10ADV | 10A.4.3 | Identify and sum arithmetic sequences, including the first *n* consecutive positive integers, and give a ‘geometric proof’ for the formulae for these sums.  (See also 10F.4.3)  [Include the use of spreadsheets or a graphics calculator to explore arithmetic sequences.] |
| 10A.5.4 | Use a graphics calculator or graph plotter and pencil and paper methods to plot and interpret a range of functional relationships, some continuous and others discontinuous, arising in familiar contexts.  [Graphics calculators can be used to explore a range of functional relationships.] |
| 10A.5.19 | Recognise a second-order polynomial in one variable, *y* = *ax*2 + *bx* + *c*, as a quadratic function; plot graphs of such functions (recognising that these are all parabolas) and identify the intercepts with the coordinate axes, the axis of symmetry and the coordinates of the maximum or minimum point; understand when quadratic functions are increasing, when they are decreasing and when they are stationary.  *Create a display like this with your graphics calculator* |
| 11ADV | 11A.5.5 | Find approximate solutions of the quadratic equation  *ax*2 + *bx* + *c* = 0 by reading from the graph of *y* = *ax*2 + *bx* + *c* the *x*-coordinate(s) of the intersection point(s) of the graph of this function and the *x*-axis.  [Include the use of a graphics calculator.] |
| 11A.5.8 | Find exactly by analytical methods and approximately by graphical methods, the solution set of two simultaneous equations L1 and Q1*,* where L1 represents a linear relation for *y* in terms of *x*, and Q1 a quadratic function of *y* in terms of *x*. |
| 11A.5.10 | Understand the statement *y is inversely proportional to x* and set up the corresponding equation *y* = *k/x*; know some characteristics, including that *x≠* 0 and that *x* = 0 is an *asymptote* to the curve, as is *y* = 0; study examples of inverse proportionality.  [Include the use of a graphics calculator.] |
|  | 11A.5.11 | Use a graphics calculator, including use of the trace function, to show approximate solutions to physical problems requiring the location and physical interpretation of the intersection points of two or more graphs. |
| 11A.5.18 | Understand the ideas of exponential growth and decay and the forms of the associated graphs *y* = *ax*, where *a* > 0; use a graphics calculator to plot the graphs of the exponential function, e*x*, and the natural logarithm function, ln *x*; know that one is the inverse function of the other and use this to find solutions to physical problems; solve for *x* the equation *y* = *ax* and use this in problems; use the log function (logarithm in base 10) on a calculator. |
| 11A.14.1 | Use coins, dice or random numbers to generate models of random data.  (See also 12F.13.1)  [These can be generated on scientific or a graphics calculator using the RND and RAN function keys.] |
| 12 ADV | 12A.5.1 | Use a graphics calculator to plot exponential functions of the form *y* = e*kx*; describe these functions, distinguishing between cases when *k* is positive or negative, and the special case when *k* is zero. |
|  | 12A.16.1 | Use coins, dice or random numbers to generate models of events described by random variables and to calculate probabilities and frequencies.  (See also 12F.13.1 and 11A14.1)  [These can be generated on scientific or a graphics calculator using the RND and RAN function keys.] |
| 12SC | 12SC.5.1 | Use a graphics calculator to plot exponential functions of the form *y* = e*kx*; describe these functions, distinguishing between cases when *k* is positive or negative, and the special case when *k* is zero. |